



## The Influence of Farmers' Behaviors on Pesticide Usage in the UAE

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### ABSTRACT

Inappropriate application of pesticides is quite common in the study area, causing health issues and in some cases fatalities. The intent of the current study is farmers behavior on pesticides usage in improving UAE agriculture. This study employed a quantitative research approach, with a cross-sectional time horizon for data collection. A developed and validated questionnaire was distributed to the farmers consisting of 310 participants selected from UAE. The data collected were analysed using Partial Least Square Structural Equation Modeling (PLS-SEM) using Smart PLS software. The results also reveal that the farmers behavior improve agriculture properly in the country and support the re-evaluation of pesticide registrations in developing countries to be in line with FAO/WHO Code of Conduct.

## 1. Introduction

Agriculture is one of the human occupations associated with a high level of risk. There are many linkages between agricultural practices and products and environmental health problems, according to evidence from throughout the world (Sarkar et al., 2012). Agricultural worker risk perception studies are frequently linked to averting any accident or occupational sickness (Cecchini et al., 2018). Due to the widespread use of pesticides and the low or inadequate reading skills of UAE farmers, occupational pesticide exposure is projected to be substantial, increasing the risk of acute and chronic poisoning to human health and the environment. The objective of this research was on farmers' knowledge, attitudes, and behaviours regarding safe pesticide usage in various locations or areas of the UAE. In addition, the study was inspired by a Chinese study (Fan et al., 2019), and we modified that questionnaire somewhat. The current research aims to (1) determine and categorise the levels of knowledge, perceptions, and behaviour associated with pesticide use in farmers of various crops, locations, as well as the actions of pesticide retailers and the government, and (2) understand the driving key factors influencing farmers' pesticide use behaviors.

UAE aspires to become a developed nation by the year 2030 through achieving Vision 2030 initiative to achieve millennium which development goals for UAE on the UAE environmental sustainability programs (MDGs report, 2000-2008). In addition, it is hoping the researcher is looking for that this study will be as a guiding policy for the development agencies in the UAE. To safety and protective behavior in handling pesticide in UAE Agriculture in use of agrochemicals in different cropping systems. Also provide useful agricultural information's to UAE farmers, so appropriate policies and developmental programs will be formulated and to be implemented for the best management practices and the utilization to achieve the sustainable development approach. and, to ensure that the Governmental agencies formulate safe quality procedures for the UAE farms. Also, this study will try to engage with the methods, policies, and practices of using, handling and disposing pesticides. A detailed study on the state's approach towards campaigns, workshops, and educational programs regarding the use of the pesticide can provide extensive understanding on the lack of awareness of farmers in using pesticides.

In contrast to industrialized nations, developing nations are more dependent on agriculture because it contributes a bigger percentage of their economies' gross domestic product (GDP). In general, the biggest GDP contributions in South Asia and Africa are attributed to agriculture Raul (2018). It was stated that the country's overall economic advances have been significantly influenced by the growing agricultural production output. Therefore, it is clear to emphasize the contribution of agriculture to national economic growth. This, in turn, calls on farmers to adopt more creative farming methods in order to increase the nation's overall agricultural output Praburaj (2018) and a report on the MDGs, 2000–2008. According to official UAE figures, agriculture accounts for 4% of the nation's total GDP, with cattle, fisheries, and other agricultural activities contributing 9 billion AED to the national economy. The government constructed a flower farm in Suheihan, which is located right in the middle of a desert. This farm produces enormous quantities of flowers every year and contributes significantly to the nation's economy. Additionally, the nation saw a growth in the production of 30 different agricultural products, including wheat and barley, which are harvested fourteen times annually.

## **2. Literature and Hypothesis Development**

### *2.1 Safety and Protective Behaviour in Handling Pesticides in Agriculture*

The negative impact of pesticides associated with cancer among farmers, it indicates that there is a significant relationship between pesticides usage and cancer, some of the cancers such as; colon cancer, non-melanoma skin cancer, lymphoma and prostate cancer, and breast cancer were common among farmers (Salerno et al, 2016; Mills et al, 2009). It was stated by different studies that disruption risk of nervous system resulted from the high usage of pesticides among farmers, it increases the risk of this disruption (Li et al, 2014). Hoppin et al., (2017) found that the non-safe usage of pesticides will lead to significant complications like respiratory dysfunction between farmers.

### *2.2 The Relationship Between Behaviour Personal Protective Equipment and Pesticide use*

According (Damalas and Koutroubas, 2017) the association of previous training in the form of intensive seminars relating to pesticide use (e.g., use of spraying equipment, application parameters, use of personal protective equipment, risks to human health and the environment) with farmers' knowledge and behavior in pesticide use was studied via the self-reporting method in a purposive sample of 82 trained and non-trained farmers. Most trained farmers showed higher levels of knowledge of pesticide use, higher levels of beliefs in pesticide hazard control, and higher levels of safety behavior than non-trained farmers. Knowledge of pesticide use and beliefs regarding pesticide hazard control were significantly correlated with safety behavior in both groups of farmers. Concerning farmers' beliefs regarding pesticide hazard control, trained farmers were more likely to think that safety precautions work very well and less likely to feel they had little control over avoiding pesticide hazards. Overall, previous training was associated with increased levels of farmers' knowledge of pesticides and beliefs about pesticide hazard control, was accompanied by elevated safety behavior in farmers, and thus related to lower occupational exposure to pesticides. Interventions that facilitate knowledge and compliance with safety behaviors should become a priority for decreasing exposure to pesticides among farmers. This theoretical deliberation along with existing empirical evidence leads to the following hypothesis:

*H: 1 behavior personal protective equipment have a significant and positive effect on pesticide use:*

### *2.3 The Relationship Between Behavior Life-Threatening Health Risks and Pesticide use.*

According (Fan et al., 2019) this studied suggests to quantitative understanding of farmers' behaviour in pesticide use is critical to enhance sustainability of chemical pest control and protect farmers' health and the environment. However, reports on the levels of knowledge and awareness of farmers and the practices of pesticide use are often insufficient. Here, we conducted a comprehensive analysis on the effects of knowledge and awareness of farmers as well as the influence of the associated stakeholders (i.e. pesticide retailers and the government) on farmers' behaviour in pesticide use by using a detailed survey of 307 agricultural households (79 grain farms, 65 fruit farms, 53 vegetable farms and 110 mixed-crop farms) in the Wei River basin in northern China. Eight protective behaviours (PBs) were exhibited by farmers. According (Bagher et al., 2018). Common safety practices in pesticide use were assessed among apple farmers in Ardabil Province, Iran. With reference to the place of storing pesticides, most farmers (60%) stated that they store the pesticides in stalls and warehouses, while 8.5% stated that they store the pesticides in their houses. The majority of the farmers (71.5%) stated that they prepare the pesticide sprays in the orchards or next to irrigation wells. Almost one out of three farmers (32.8 %) reported that they dump the empty containers in the orchard fields and almost an equal proportion (30.2%) reported that they usually bury the empty containers. Irritating (burning) eyes and blurred vision were symptoms that the majority of respondents had experienced. This theoretical deliberation along with existing empirical evidence leads to the following hypothesis:

*H: 2 behavior life-threatening health risks have a significant and positive effect on pesticide use.*

### *2.4 The Relationship Between Behaviour Applying of Safety and Health During Spraying and Pesticide use.*

According (Devi, 2015) the understanding on various aspects of pesticide-use has revealed better awareness in certain aspects and poor understanding in certain others. The short-term health risk upon occupational exposure has been reported very common; its frequency increases as one gets more years of experience in the work. It has been attributed to their inadequate understanding of the toxicity levels, unscientific handling practices and poor personal protective mechanism. The study has highlighted the need for targeted trainings to farm labourers besides farmers on the scientific management of pesticides and undertaking of massive awareness generation programmes.

According (Moradhaseli et al., 2017). purpose of this study was to investigate the safety and protective behavior of farmers in relation to the application of chemical pesticides in the fields and the factors influencing their behavior. Methods: This quantitative and survey research was conducted in Mahidasht County, Kermanshah Province, in 2016. The population consisted of 170 farmers (N=200) Mahidasht County, who were determined by randomly method. Questionnaire used as a research tool. Validity and reliability of the tool were confirmed by a panel of experts and Cronbach's alpha coefficient. Correlation coefficient and statistical test was used for analyzing the data by SPSS20. Findings: Most people have poor

performance in the use of protective equipment when spraying pesticides. There was positive correlation between safety behavior of using pesticides, work experience, economic status, attitudes toward the correct application of pesticides, and participating in training. Conclusion: Due to the farmers' inappropriate performance in safety and protection actions and significance relationship between participation in the training programs and safety behavior, it is necessary to design education programs to improve their knowledge. This theoretical deliberation along with existing empirical evidence leads to the following hypothesis:

*H: 3 behavior applying of safety and health during spraying have a significant and positive effect on pesticide use*

#### 2.5 The Relationship Between Behavior Based on the use of Empty Poisons and Pesticide use.

According (Sooriyaarachchi et al., 2018) the study was carried out in Nuwara Eliya district of Sri Lanka among 100 farmers, selected based on convenience sampling technique. To accomplish the objectives of the study, field surveys, direct observations, and formal and informal discussions with the stakeholders and participatory appraisal techniques were employed. About 40% of the farmers interviewed were well aware about the triple rinsing mechanism. In addition, farmers cannot access easily to the barrels to put their empty bottles after spraying. The overall container management program was rated as “good” in this stage. It was identified the need of integrating the project with the existing government programs, existing Community-based organization (CBOs), and other possible stakeholders. Both short- and long-term adjustments were proposed. Mismanagement of agrochemical waste constitutes a major environmental problem, resulting in pollution of soil, air, and water resources and compromising the agricultural products safety, the protection of the environment, and public health (Damalas, 2017). This theoretical deliberation along with existing empirical evidence leads to the following hypothesis:

*H: 4 behavior based on the use of empty poisons have a significant and positive effect on pesticide use.*

### 3. Conceptual Framework

The conceptual framework shown in Figure 1 shows all the independent variables as well as the dependent variables. The framework explains clearly how the postulated hypotheses relate to each other and provides the key input of this research. Based on the discussion above, a research framework has been developed as shown in Figure 1.

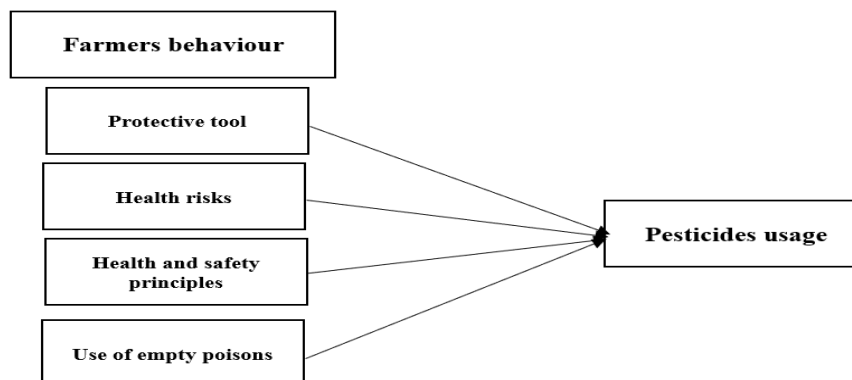


Figure: 1 Conceptual framework

### 4. Data and Methodology

Respondents 381 farms were selected to serve as the sample size intended for this research in UAE. For the purpose of reduction, the unusable questionnaire and improving the responding rate, 533 questionnaires were distributed to the sample. From the distributed questionnaires, 389 were re-turned and collected, 310 questionnaires were the net returned and usable questionnaires with a percentage of 72.00%, as 79 questionnaires are neglected due to incomplete information. This sample response met the minimum sample requirement at which generalization may be achieved. A period of six (6) weeks was allocated to collect data. The results were downloaded from the online data collection platform and analyzed with Analysis of (Smart PLS). The collected data was originally entered into the online data collection platform based on the weights of the various responses.

#### 4.1 Demographic Analysis

Table 1 shows the respondents profile for those participated in the study. As shown in the table, 41.4% of the participants belongs to the male gender category and (n=128), while 58.6% of the participants belongs to the female gender category and (n=182). The age levels of the participants divided into 4 categories, where 44.8% ranged between 18-25 years of age with n = 138, 33.9% ranged between 26-35 years of age with n = 105, 16.1% ranged between 36-45 years of age with n = 50, and 5.2% were 46 years of age and above with n = 17 from the sample. Most of the participants hold a bachelor's degree with a percentage of 58.3% with n = 180, for the diploma degree, there were 32.6% with n = 101 respondents, and for the master level, there were 9.1% with n = 29. The income level of the participants ranged between 1 to above 1501 \$, 31.5% of the participants had income ranged between 1-500 \$ with n = 97, 30.7% of the participants had income ranged between 501-1000 \$ with n = 95, 20.8% of the participants had income ranged between 1001-1500 \$ with n = 64, finally, 16.9% of the participants had income above 1501 \$ with n = 54.

| Table: 1 Profile of respondents (N = 310) |     |       |                 |     |       |
|-------------------------------------------|-----|-------|-----------------|-----|-------|
|                                           | n   | %     |                 | n   | %     |
| Gender                                    |     |       | Education Level |     |       |
| Male                                      | 128 | 41.4  | Diploma         | 101 | 32.6  |
| Female                                    | 182 | 58.6  | Bachelor        | 180 | 58.3  |
| Total                                     | 310 | 100.0 | Master          | 29  | 9.1   |
|                                           |     |       | Total           | 310 | 100.0 |
| Age                                       |     |       | Income          |     |       |
| 18-25                                     | 138 | 44.8  | 1-500           | 97  | 31.5  |
| 26-35                                     | 105 | 33.9  | 501-1000        | 95  | 30.7  |
| 36-45                                     | 50  | 16.1  | 1001- 1500      | 64  | 20.8  |
| 46 and up                                 | 17  | 5.2   | Above 1501      | 54  | 16.9  |
| Total                                     | 310 | 100.0 | Total           | 310 | 100.0 |

#### 4.2 Measurement Model Evaluation

The reliability test has been used to identify the consistency level among the variable's items used in the questionnaire. According to Hair et al., (2017), the Cronbach alpha and composite reliability values are used to measure the reliability of the variables, the values should be above 0.7 to be acceptable. According to the findings in table 4.9, it has been found that the variables (protective tool, health risks, health and safety principles, use of empty poisons, and pesticides usage) had the total number of items = 22. These 22 items have revealed great internal consistency with Cronbach alpha values ranged between 0.783 and 0.898, as well as composite reliability values ranged between 0.875 and 0.925. The convergent validity test is also employed for testing the validity of the collected data. The convergent validity test is used to ensure the similar construct of the items should reflect high correlation among these items. According to (Atreya et al. 2020) the average variance extracted (AVE) should be greater than 0.5 to be acceptable. Based on the findings on the following table 2, the AVE for the variables (protective tool, health risks, health and safety principles, use of empty poisons, and pesticides usage) were ranged between 0.642 and 0.755.

| Table: 2 Measurement model evaluation |                  |                       |                                  |
|---------------------------------------|------------------|-----------------------|----------------------------------|
|                                       | Cronbach's Alpha | Composite Reliability | Average Variance Extracted (AVE) |
| HR                                    | 0.898            | 0.921                 | 0.663                            |
| HSP                                   | 0.892            | 0.925                 | 0.755                            |
| PT                                    | 0.816            | 0.878                 | 0.642                            |
| PU                                    | 0.895            | 0.923                 | 0.704                            |
| UEP                                   | 0.783            | 0.875                 | 0.701                            |

Keywords: PT: Protective tool; HR: Health risks; HSP: Health and safety principles; UEP: Use of empty poisons; PU: Pesticides usage

#### 4.3 Discriminant Validity

The convergent validity test is also employed for testing the validity of the collected data. The convergent validity test is used to ensure the similar construct of the items should reflect high correlation among these items. According to (Atreya et al. 2020) the average variance extracted (AVE) should be greater than 0.5 to be acceptable. Based on the findings on

the following table 3, the AVE for the variables (protective tool, health risks, health and safety principles, use of empty poisons, and pesticides usage) were ranged between 0.642 and 0.755.

Table: 3 Results of discriminant validity by Fornell-Larcker criterion

|     | HR    | HSP   | PT    | PU    | UEP   |
|-----|-------|-------|-------|-------|-------|
| HR  | 0.815 |       |       |       |       |
| HSP | 0.066 | 0.869 |       |       |       |
| PT  | 0.274 | 0.184 | 0.801 |       |       |
| PU  | 0.142 | 0.077 | 0.348 | 0.839 |       |
| UEP | 0.291 | 0.441 | 0.443 | 0.204 | 0.837 |

Finally, the measurement model of the study is presented in figure 2 below. Based on the above discussion, it can be confirmed that the measurement is valid for further analysis as suggested by Hair et al. (2010).

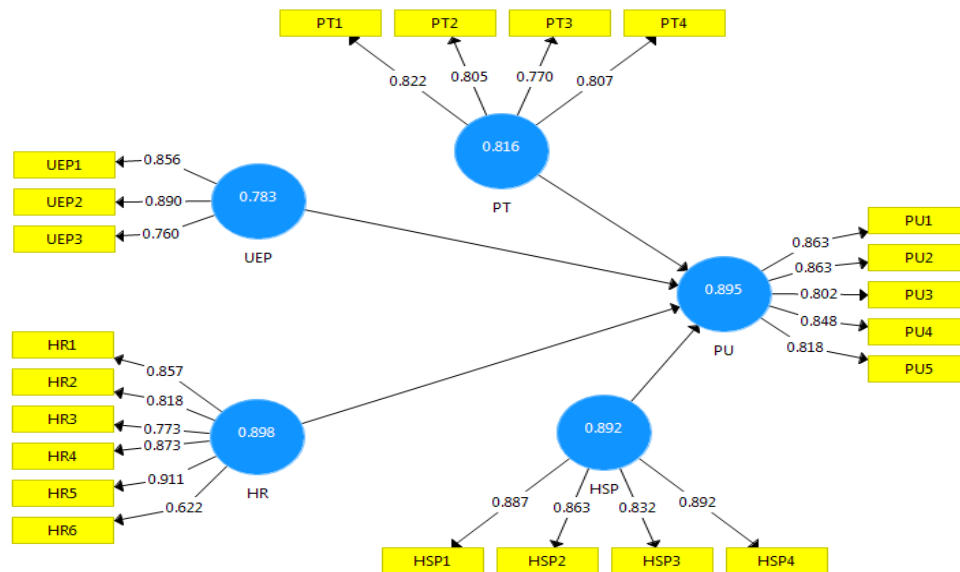


Figure: 2 Measurement model of the study

## 5. Results

### 5.1 Hypothesis Testing

The direct effect test is used to examine the relationships between the (independent and mediating) variables and the dependent variable. This section presents the result of hypotheses testing for direct effect. The results are presented in table 4 and explained in the following conclusions.

Table: 4 Summary of the direct effect

| Path analysis | Beta  | SD    | T-value | P Values | Decision  |
|---------------|-------|-------|---------|----------|-----------|
| HR -> PU      | 0.221 | 0.033 | 6.770   | 0.000    | Supported |
| HSP -> PU     | 0.008 | 0.053 | 0.150   | 0.881    | Rejected  |
| PT -> PU      | 0.648 | 0.046 | 14.078  | 0.000    | Supported |
| UEP -> PU     | 0.150 | 0.031 | 4.813   | 0.000    | Supported |

According to results showed in the above table 5, the following conclusions were drawn:

- There is a significant positive relationship between protective tool and pesticides usage with  $\beta = 0.648$ ,  $T = 14.078$ , and the level of significance = 0.000.



- There is a significant positive relationship between health risks and pesticides usage with  $\beta = 0.221$ ,  $T = 6.77$ , and the level of significance = 0.000.
- There is no significant relationship between health and safety principles and pesticides usage with  $\beta = 0.008$ ,  $T = 0.150$ , and the level of significance = 0.881.
- There is a significant positive relationship between use of empty poisons and pesticides usage with  $\beta = 0.150$ ,  $T = 4.813$ , and the level of significance = 0.000.

## 6. Discussion

In this study, the results show that the middle-aged people of the UAE are more engaged in agriculture and farming than the youth. Illiteracy is prevalent among farmers, and due to ignorance, they mainly rely on the advice of neighbouring farmers and do not get information from the Department of Agriculture (Extension) on biosafety measures. These results are similar to the results of the previous studies, where (Damalas, 2017) mentioned that the association of previous training in the form of intensive seminars relating to pesticide use (e.g., use of spraying equipment, application parameters, use of personal protective equipment, risks to human health and the environment) with farmers' knowledge and behavior in pesticide use was studied via the self-reporting method in a purposive sample of 82 trained and non-trained farmers. Most trained farmers showed higher levels of knowledge of pesticide use, higher levels of beliefs in pesticide hazard control, and higher levels of safety behaviours than non-trained farmers. Knowledge of pesticide use and beliefs regarding pesticide hazard control were significantly correlated with safety behavior in both groups of farmers. Concerning farmers' beliefs regarding pesticide hazard control, trained farmers were more likely to think that safety precautions work very well and less likely to feel they had little control over avoiding pesticide hazards.

Overall, previous training was associated with increased levels of farmers' knowledge of pesticides and beliefs about pesticide hazard control, was accompanied by elevated safety behavior in farmers, and thus related to lower occupational exposure to pesticides. Interventions that facilitate knowledge and compliance with safety behaviors should become a priority for decreasing exposure to pesticides among farmers. According (Devi, 2019) the understanding of various aspects of pesticide use has revealed better awareness in certain aspects and poor understanding in certain others. The short-term health risk of occupational exposure has been reported very common; its frequency increases as one gets more years of experience in the work. It has been attributed to their inadequate understanding of the toxicity levels, unscientific handling practices, and poor personal protective mechanisms. The study has highlighted the need for targeted training for farm labourers besides farmers on the scientific management of pesticides and the undertaking of massive awareness generation programs.

## 7. Conclusion

This study concentrated on safety and protective behaviour in handling pesticide in UAE agriculture and agrochemicals pollution due to agricultural activities in agricultural, where agrochemicals are applied for farmer's agricultural management. This research work has been conducted in the UAE context to explore the agrochemicals effect from the usage of pesticides, it was highlighting the usage and pesticides effect practices and measures to design the mitigation procedures and also to develop the associated strategies in this regard to ensure the protective behaviours practices and the safety measures for the farmers to achieve the ecological sustainability. The outcome of this study to provide useful agricultural information's to UAE farmers, so appropriate policies and developmental programs will be formulated and to be implemented for the best management practices and the utilization to achieve the sustainable development approach. Moreover, the outcome of this research could be used as management and planning tool by the UAE agricultural experts. In addition, the findings can be associated to be a key information that helps the formal agencies to formulate the mitigating procedures and measures in order to agrochemicals pollution, and also to ensure that the governmental agencies formulate safe quality procedures for the UAE farms.

## 8. Limitations and Directions for Future Research

For this research, the main limitation is concerned that there is an insufficient amount supportive evidence regarding the implementation of safety and protective behaviour in handling pesticide in UAE polices. Moreover, there still do not have previous research related to implementation of safety and protective behaviour in handling pesticide in UAE. Hence, the basic of this research is majority based on other countries studies. This research highlights the implement of implementation of safety and protective behaviour in agriculture sector. The limitation that occurs is majority of agriculture sector have not fully utilised safety and protective behaviour yet. Therefore, this research only focusing on Agriculture sector in UAE. This research also reveals that farmers don't follow the recommendations of the extension department or the instructions printed on pesticide bottles/containers. Based on the outcomes of this study, it is recommended that educational programs (formal and informal) and training in pesticide usage (Biosafety) be planned to assist farmers in enhancing their knowledge and skills, and to encourage them to adopt safety measure.

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